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The wave energy resource along Australia's southern margin

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The Southern Australian margin is one of the most energetic regions in the world suitable for the extraction of wave energy for electricity generation. We have produced a data set in which the deep-water wave energy resource for the region is described by three representative deep-water wave states, equivalent to the 10th, 50th, and 90th percentiles of the deep-water wave energy flux, derived from archives of the USA National Oceanic and Atmospheric Administration (NOAA) WaveWatch III (NWW3) operational wave model. The Simulating WAves Nearshore (SWAN) wave model is then applied along the full Southern Australian margin to propagate these representative wave states into the near-shore region to quantify the effects of shallow water processes such as refraction, shoaling, and bottom friction. The wave energy incident on the 25-m isobath (∼30–50 kW/m) is approximately 35%–50% less than the World Energy Council estimates of offshore wave energy but is approximately 20% greater than the energy observed from long-term buoy deployments on the midshelf. We estimate that if 10% of the incident nearshore energy in this region, which is an ambitious target when conversion efficiency is considered, were converted to electricity, approximately 130 TW h/yr (one-half of Australia's total present-day electricity consumption) would be produced.

One problem with several forms of renewable energy is the intermittency of energy supply. We have assessed the spatio-temporal variability of the wave energy resource in in-situ buoy records along the Australian coast, focusing on how this compares with statistics of the more familiar wind energy resource. Combining resource across 3 buoy sites distributed across ∼1000km in south-east Australia, wind energy (at adjacent land sites) is less than 25% of the mean wind energy for 19% of the time and wave energy is less than 25% of the mean wave energy for 5% of time. Combining supply from wind and wave resources adds value in supplying a consistent energy supply. Whether these advantages compensate for the inevitably greater costs associated with operating in the marine environment is not yet clear.